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## Discussion on Feasibility of GDP-Indexed Bonds in Emerging Economies –Viewpoint India

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### Abstract

In their endeavor to sustain high level of economic growth rate, emerging economies are prone to financial distress and burgeoning indebtedness. Exceeding reliance on foreign investments exposes to the risk of growth rate fluctuations. GDP-Indexed Bonds have been proposed as an instrument to hedge against debt trap, growth rate fluctuations and external economic turbulences. Return on these bonds is in direct relationship with GDP growth rate. The economic growth rate impacts interest rates as well, thereby affecting the returns on vanilla bonds. Anticipating a correlation between returns on GDP-Indexed bonds and plain vanilla bonds, monthly data has been collected on GDP growth rate and 10-Year bond yield to determine the strength of association between the two types of bonds. Furthermore, this study explores the hedging possibilities for investors and comments upon the utility of GDP-indexed bonds in Indian context. The results may find use with large corporations, pension funds and overseas investors.

**Keywords:** interest rate, economic growth rate, GDP-indexed bond, vanilla bond

### 1. Introduction

Regional and global economic crises have profound impact on financial health of nations, triggering regulatory and policy responses by national and international agencies (World Bank, IMF, etc.). The interim and long-term fiscal and monetary policy measures include bailout and stimulus packages, lessening of tax burden, currency depreciation, debt restructuring, export market diversification and so on. The international financial institutions respond through extension of credit lines and balance of payment support.

Easterly (2001) has attempted to establish a relationship between economic growth rate, indebtedness of sovereign states and financial crisis. The study found evidences of strong linkage between decline in GDP growth and economic crisis. In another research work, Cleassens (2010) reported that the two initial shocks experienced by the Emerging Economies during the recent US financial crisis of 2007-08 were drop in capital inflow and shrinkage of export demand. In 1990s, similar contingencies, although of different intensities, have been felt during the Asian crisis, the Mexican Peso devaluation and the Argentinean financial crisis. An offshoot of the endeavour to minimize the possibility of repetition of such financial mess was designing of financial instruments that were countercyclical to economic turbulences and could be of some relief for the economies facing hardship in servicing their debt. One such instrument is GDP-Indexed bond.

GDP-indexed bonds are financial instruments that are positively correlated with the economic growth rate of a country and can be issued to stabilize debt servicing of the nation. The borrowing country can design these bonds in such a way that the coupon payment increases or decreases by particular basis points for every percent rise or fall in the GDP growth rate above or below the predefined threshold rate (Borensztein & Mauro, 2004). Linking these bonds with GDP growth rate ensures that the borrower rewards its lenders well during the periods of robust growth and saves upon debt payments during slump periods. This stabilizes the costs of debt servicing as opined by Chamon and Mauro (2006). This arrangement of debt servicing can reduce the risk of sovereign default and assure safe returns for the investors. Macro-economic factors like growth rate fluctuation, capital and currency volatility and high debt to GDP ratio make GDP-indexed bonds a useful instrument for emerging economies (Griffith-Jones & Sharma, 2006). The benefits to the investors include portfolio diversification, lower default risk and an opportunity to take equity-like exposure in a country's growth. By stabilizing economic growth and reducing debt servicing default, GDP-indexed bonds reduce the chances of economic crisis and contagion effect arising thereof (Mendoza,

2009). While the GDP-linked bonds are primarily perceived as sovereign bonds wherein nations are the issuers of such financial instruments, the same can be issued by regional trading blocs, large firms, banks and other financial institutions as well. These bonds are hybrid in nature – while they are known as ‘Bond’ per say, indexation with the economic growth rate gives them the equity-like characteristics (Ruben, Poon, & Vonatsos, 2008).

The benefit in coupon payment arising out of use of GDP-indexed bonds can be understood by taking a hypothetical case of a country where real GDP growth rate has averaged at 3 percent over the years and the general expectation is that it will remain doing so in future as well. It may also be assumed that this economy is able to issue plain vanilla bonds on regular basis at 7 percent interest. Then, this country may consider floating a local currency- denominated bond which is linked to its economic growth rate. According to Borensztein, Chamon, Jeanne, Mauro, and Zettelmeyer (2004), the expected coupon rate could be:

$$\text{Coupon}^{**} = \max [r + (g^{**} - g^*), 0], \quad (1)$$

Where,

$g^{**}$  = present growth rate of GDP,

$g^*$  = baseline growth rate of GDP, and;

$r$  = regular plain vanilla bond rate.

In this case, the contracting parties could mutually decide upon baseline growth rate of GDP prior to the issue of this bond. Long -term GDP growth rate can be safely taken as the baseline rate (3 percent in this case). Need-based insurance premium can also be included over and above the regular plain vanilla bond coupon rate. In the example discussed above, insurance premium is zero (Borensztein et al., 2004). The issuing country may decide to reduce the annual coupon payment by 100 basis points for every 1 percent fall in the GDP growth and vice-e-versa. The floor and cap of coupon payment can also be decided upon and stated in the contract. Now, if the economic growth rate of the country for a particular year (or quarter; whatever forms the basis for pricing of this bond) happens to be 1 percent, the coupon payment will be 5 percent. Conversely, when the economic growth rate is 6 percent, the coupon payment will be 10 percent.

The hypothetical example cited earlier shows that debt servicing is smoother for sovereign states when bonds are linked with economic growth rate. Rather than servicing at a uniform rate of 7 percent, the country saves on debt repayment during periods of economic slowdown and makes better payments to its creditors when the growth is robust.

As of now, GDP-indexed bond has been introduced in countries such as Argentina, Bulgaria, Costa Rica and Bosnia and Herzegovina. In most of the cases, this financial instrument was used under Brady arrangement for restructuring of sovereign debt (D’Souza, Kumar, Mandal, & Virmani, 2010; Tabova, 2005).

Theoretically, GDP-indexed bonds are expected to stabilize debt repayments and reduce sovereign default risk. However, there are practical issues associated with introduction of these bonds. Negative moral hazard on the part of the borrower, difficulty in pricing of these bonds, issue of reliability and accuracy of GDP data and market illiquidity for these bonds are some of the hindrances in development of deep market for these bonds (Borensztein & Mauro, 2002; Costa, Chamon, & Ricci, 2008; D’Souza et al., 2010; Griffith-Jones & Sharma, 2006; Kletzer, 2005).

## 2. Literature Review

GDP-indexed bonds are relatively recent in concept and origin. Hence, a large section of research work in this area is dedicated to describing the characteristics of these bonds and establishing their utility for the countries facing unfavourable debt servicing condition (Borensztein & Mauro, 2004; D’Souza et al., 2010; Griffith-Jones & Sharma, 2006; Lorenzo & Noya, 2006; Mendoza, 2009; Schroder, Kruse, Meitner, & Heinemann, 2004). Most of these researchers have stressed upon the positive effect of GDP-indexed bonds on debt repayments of emerging economies.

Another significant area of research on GDP-indexed bonds is related to price determination. Since, this is a new financial instrument with no benchmark to compare to; determination of coupon rate, risk premium and market premium, etc. needs to be computed. Studies focussing on the pricing aspect of these bonds have generally used

Monte-Carlo simulation for price determination. (Chamon & Mauro, 2006; D'Souza et al., 2010; Faria, 2005; Kruse, Meitner, & Schroder, 2005; Schroder et al., 2004). Examples of countries such as Mexico, Argentina, Bulgaria, Bosnia and Herzegovina, Chile and Costa Rica have been frequently used by researchers to establish theoretical discussions and empirical validation of GDP-indexed bonds (Chamon & Mauro, 2006; Costa et al., 2008; D'Souza et al., 2010; Griffith-Jones & Sharma, 2006; Ruben et al., 2008; Pernice & Fagundez, 2005; Sandleris & Taddei, 2007; Tabova, 2005).

Moral hazard on the part of the issuer of GDP-indexed bond and resulting scepticism regarding reliability of the GDP data used to price the bond can be a hindrance in the development of deep market for GDP-indexed bonds. Researchers have suggested active role for international financial institutions such as International Monetary Fund, Asian Development Bank and the World Bank in supervising the GDP data generated by bond issuing countries. Another suggestion is to ensure greater independence for the statistical organizations performing GDP growth rate data computation (Borensztein et al., 2004; Buckley & Dirou, 2006; Lorenzo & Noya, 2006). A broad classification of the literature on GDP-indexed bond has been tabulated under Table -1. The resultant SWOT Analysis on the basis of comprehensive review of the literature on GDP-indexed bond can be seen in Figure-1.

Owing to the novelty of this financial instrument, the existing literature has concentrated on describing the characteristics of GDP-indexed bonds. Since the basic objective is to smoothen up the debt servicing of the borrowing countries and reduce instances of repayment default, the researchers have adopted borrower's perspective while designing this bond. Essential aspects such as coupon rate, pricing, valuation, indexation and market have been analysed with the aim of mitigating the adverse effects of high indebtedness of the borrowers. With the exception of a few research works (Ruben et al., 2008; Schroder et al., 2004), not many researchers have attempted to address the investors' perspective regarding this bond. Even in the two studies quoted above as exceptions, the stress areas are pricing of GDP-indexed bonds and risk of default by the issuer of these bonds. Implication for the investors has been given a secondary treatment in their papers. In comparison, this present study adopts the investors' perspective on indexed bonds and explores the expected benefits for the buyers. The focus is on Indian market. The two objectives of this paper are:-

1. Explore the hedging opportunity for an investor interested in countercyclical financial instruments. This is done by studying the degree of association between returns on GDP-indexed bonds and 10-Year sovereign bonds in India.
2. The second objective of this paper is to critically analyse the rationale behind introduction of GDP-indexed bonds in emerging economies, especially India. The paper uses various levels of indexation of coupon payments to understand the impact of interest payments on debt burden for the Indian government.

The rest of the paper has been organized as follows: Section (3) describes the underlying rationale for hedging opportunity for the investors buying GDP-indexed bonds. The findings and discussions follow. Section (4) is a commentary on the work of D'Souza et al., (2010) to discuss the possibility of introduction of GDP-indexed bonds in India. The coupon rate indexation has been used to draw conclusions. Section (5) concludes the study and highlights the future research possibilities as well as the limitations of this research work.

### **3. Rationale for the Hedging Opportunity**

A stylized fact about bonds is that they are in inverse relationship with the interest rates. For straight bonds wherein coupons are fixed but not the price, a rise in the interest rate will lower its price and vice-e-versa. In contrast, GDP-Indexed bonds are positively linked to the economic growth rate of a country. A rise / fall in the GDP growth rate will increase / lower the returns for the investors who hold these bonds. Also, during economic growth periods, with the assumption of demand-supply gap existing in that economy, this paper assumes that the rising inflation will prompt the central bank for a contractionary monetary policy and the interest rates will rise. Since, interest rates are inversely related to the bond prices, an element of negative correlation can be expected between GDP-indexed bonds and plain vanilla bonds (straight bonds). If the interest rates in a particular economy are highly sensitive to the economic growth rate, more pronounced hedging is possible.

Ruben et al. (2008) have suggested that for better servicing of debt, sovereign nations should index the GDP bonds with the nominal growth rate of the economy. In their study, the authors have reported that the use of GDP growth

rate (Real) is less effective in reduction sovereign default risk. In consideration of their work, this study correlates the yield on 10-year sovereign bonds with Real and Nominal growth rates, both.

### 3.1 Data and Methodology

Eleven years' monthly data from 2000 through 2010, on real and nominal GDP growth rate (Y-on-Y basis) and 10-year sovereign bond yield has been collected from the websites of Gecodia.com and Economic Times Intelligence Group (ETIG). This time period has been selected because, as evident from Figure-3, this is a period of volatility in the real GDP growth rate and offers a good chance for studying the effect of indexation. While the figures on 10-year bond yield are monthly, the data of GDP growth rate are quarterly and have been averaged for all the relevant three months of a particular quarter.

In practice, the GDP-indexed bond may be fixed at a basis point, up and below, with the plain vanilla bond. The baseline growth rate, also the initial rate for take-off of GDP growth can be the long-term average of GDP-growth rate. For the sake of simplicity, this paper uses the equation for computation of the coupon rate as illustrated by Borensztein et al. (2004) and used in Equation (1). The equation is:

$$\text{Coupon}^{**} = \max [r + (g^{**} - g^*), 0],$$

Where,

$g^{**}$  = actual growth rate of GDP on the date of issue of bond

$g^*$  = baseline growth rate (Average of GDP growth taken from 1951 to 1998)

$r$  = expected coupon rate on plain vanilla bond

However, the above equation implicitly assumes one-to-one relationship between GDP growth rate and coupon payment and fails to incorporate any element of sensitivity in coupon indexation. This weakness can be eliminated by incorporating beta ( $\beta$ ) in the above equation (Campiglio, 2006). While inclusion of beta provides opportunity for different degrees of indexation, the basic equation for computation of coupon payment still remains simple. The value of beta can vary between 0 and 1. The revised equation will be:-

$$\text{Coupon}^{**} = \max [r + \beta (g^{**} - g^*), 0], \quad (2)$$

Where,

$\beta$  = Degree of indexation of coupon payment to economic growth rate.

For the purpose of this calculation, equation (1) has been considered. The degree of indexation of coupon payment is 1:1 with the GDP growth rate. The expected coupon rate on plain vanilla bond has been taken as 5.5% which is the twenty-year average of bond yield on 10-year plain sovereign bond from 1970 to 1990 as computed by Ibbotson and retrieved from the lecture slides of Damodaran, Aswath. The baseline growth rate (in real terms) has been taken as 4.4% which is the 48-year (1951-1998) annualized average of economic growth rate in India. The same for nominal growth rate has been taken as 11%.

### 3.2 Discussion of Results

The Table-2 shows the descriptive statistics of the data considered for this study. As expected, the standard deviation and variance are higher for nominal GDP growth rate due to the effect of GDP inflator. The mean returns are highest for GDP-indexed bonds linked with real growth rate.

The results of Table-3 show the pair-wise correlation between 10-year bond and GDP-indexed bonds (indexed to real and nominal growth rates). Here, the findings reveal negative correlation between the 10-year sovereign bonds and GDP-bonds (Real) for the period taken into consideration. The finding is significant at 99% confidence level and is consistent with our rationale that the GDP-indexed bond rates are in inverse relationship with plain vanilla bond yield. Hence, this provides an opportunity for investors to diversify investments and hedge risk. The same is not true for GDP-indexed bonds linked with nominal growth rates and 10-year bonds. Here, a negative correlation of 0.057 is statistically insignificant and does not bring any effective hedging benefits for the investors.

#### **4. Feasibility of GDP-Indexed Bonds in the Indian Market**

Perhaps, the most influential study on feasibility of GDP-indexed bonds in Indian market has been done by D'Souza et al. (2010). Sponsored by the Reserve Bank of India (RBI), this study explores the relevance of GDP-indexed bonds in the Indian context and concludes that several practical issues make this instrument undesirable for India. The authors have identified accuracy of GDP data, market illiquidity for such bonds and bond pricing as the major hindrances behind successful introduction of these bonds. Since the time horizon to reap economic benefits of GDP-indexed bonds is large (5-10 years), the authors question the political will of incumbent government for floating this bond. This apart, since this new instrument will require higher coupon payments to gain popularity, the issuing authorities will find it difficult to justify introduction of this bond, especially in the wake of buoyant performance of Indian economy.

Market illiquidity for such financial instruments is a concern for D'Souza et al. (2010). They cite the instances of 10-Year government bonds being held till maturity and assert that unless there is international cooperation on this issue, whereby many economies float this instrument and make comparison and price discovery easy for overseas investors, this bond may fail to succeed. The authors have stressed upon strengthening of policy making institutions rather than resorting to the instrument of financial reengineering. To conclude, their study rejects the idea of GDP-indexed bonds for Indian markets.

##### *4.1 Commentary on the work of D'Souza et al. (2010)*

In their paper "GDP-indexed Bonds", the authors have concentrated on the feasibility and pricing aspects of GDP-indexed bonds. Mentioned below is our commentary on the major practical issues, as opined by the authors, which can hinder the development of a market for GDP-indexed bonds:-

##### **4.1.1 Authenticity of GDP Data**

Numerous research papers (Borensztein & Mauro, 2004; Griffith-Jones & Sharma, 2006; Lorenzo & Noya, 2006; Mendoza, 2009; Schroder et al. 2004) have commented on this issue and the common outcome is that no country can continue to fudge with the national data for long and if she does so then at her own peril. Moreover, international agencies such as IMF, World Bank and Asian Development Bank can have important role in improving the quality of the data generated in an economy. This will also lead to transparency in the national accounting process.

##### **4.1.2 Pricing of GDP-Indexed Bonds**

Like any other bond, the pricing of this bond also poses challenges. However, the market players have been pricing other bonds of similar complexity. Hence, this aspect should not cause much worry once the sovereign states decide to float this bond (Borensztein & Mauro, 2002).

##### **4.1.3 Market Illiquidity**

The authors assert that this bond will require heavy fiscal commitment for introduction of this bond. To ensure enough trading volume, the authors argue that this bond should be launched in cooperation with the international community. This suggestion has been given by previous researchers as well (Borensztein et al., 2004; Chamon & Mauro, 2006; Griffith-Jones & Sharma, 2006; Schroder et al. 2004). One suggestion this paper intends to make at this point is that the borrower country can contemplate issuing GDP-indexed bonds of smaller denominations and in smaller lot size so as to increase liquidity. This may be of help even in the case of lesser number of nations floating this bond.

##### **4.1.4 Time of floatation of this bond**

The authors have argued that GDP-indexed bonds have been so far used for debt restructuring only. Since India has never defaulted on her debt repayment, this instrument is not required for this country. They also assert that today, when the Indian economy is in buoyant phase, introduction of such bond will give negative message to the market

and will erode investors' confidence. This argument is in contrast to the suggestion made by Griffith-Jones & Sharma (2006) who propose that issuance of this bond by strong economies will send positive signals among the investors and will popularize this instrument. The present study argues that a well designed and properly timed financial instrument will have better chances of acceptability by the market.

The arguments made in the preceding paragraphs suggest that GDP-indexed bonds can be successfully floated in India. However, meticulous designing of the instrument will be essential in smooth acceptance by the market.

#### 4.2 Comparison of Coupon Rate Indexations

One proposed benefit of GDP-indexed bond is its ability to soften debt repayment. In confirmation with Chamon and Mauro (2006), D'Souza et al. (2010) have also found that use of this instrument will reduce debt burden on a country. An important part in designing of GDP-indexed bond is its indexation. Schroder et al. (2004) have suggested that indexation can be done in the coupon rate or the price of the bond. In an attempt to understand the impact of coupon repayment on debt burden arising out of the use of this bond in India, this paper makes use of the revised Equation (2) to index the coupon rate with the plain vanilla bond rate. Three levels of indexation have been used – 100%, 50% and 25%. The June, 2000, figure of 10-year sovereign bond (11%) has been chosen for coupon payment of plain vanilla bond. Consequently, the semi-annual payment comes out to be 5.5 %. The time period from 2000 through 2010 shows high volatility in GDP growth rates. This gives a good reason to study the effect of coupon indexation. The basic equation for empirical analysis is:

$$\text{Coupon}^{**} = \max [r + \beta (g^{**} - g^*), 0],$$

Where,

$\beta$  = Degree of indexation of coupon payment to GDP growth rate (100%, 50% and 25% in this case)

$r = 5.5 \%$

$g^* = 4.4 \%$

$g^{**}$  = actual GDP data for the quarter

The results can be seen in the Figure-2.

##### 4.2.1 Discussion

As evident from the results of indexation in Figure-2, for major part of the period 2000 - 2010, the indexed coupon payments are above the straight bond payment. The trend remains similar for all the three levels of indexation. The use of beta value of 0.25 gives the closest result with the plain vanilla bond. Barring two periods, that of 2001 and 2002-03, where the coupon was lower than the straight coupon payment, the burden of interest payment has remained higher for the country. The results are similar to that achieved by Schroder et al. (2004) who report that investors are better off with GDP-indexed bonds because the returns for the same are in excess of the returns on plain vanilla bonds.

The above result demands for better method of indexation to make GDP-indexed bonds successful in India. In continuation with the suggestion of Schroder et al. (2004), indexation of GDP rate with price of the bond can also be attempted. The proposition of Ruben et al. (2008) that indexation of GDP bonds with the nominal growth rate will give better result is most likely to fail in the Indian context. This is because the nominal growth rate, as evident from the Table-2, has higher Standard Deviation and Variance. Hence, the coupon payments are expected to be still higher as compared to the result in Fig.-2.

## 5. Conclusion

GDP-indexed bonds are seen as a financial instrument which act as automatic stabilizers and decrease the dependence on pro-cyclic fiscal policies. Since, the level of debt servicing is low during the time of economic



distress; these bonds also reduce the sovereign default risk. The existing literature recommends the use of these bonds in emerging economies. Factors such as growth rate fluctuations, higher capital and currency volatility and unfavourable debt to GDP ratio make GDP-indexed bonds a useful instrument for these countries. The volatility of growth rates is an attractive proposition for external investors. However, accuracy of growth rate data, pricing of these bonds, market liquidity and moral hazard remain a problem.

GDP-indexed bonds have been applied in some countries, although as a debt restructuring instrument. They have met with moderate success. In Indian context, the Reserve Bank of India has not shown interest to launch such a product. The operational issues attached with the introduction of these bonds make them undesirable. For Bank, the stress is rather on strengthening of fiscal policies.

This paper adopts investor's perspective on GDP-indexed bonds. The empirical findings of this paper reveal a negative relationship between the returns on GDP-indexed bonds linked with economic growth rate (in real terms) and 10-year bond yield. Hence, a possibility of hedging exists for the investors when such bonds are floated in Indian markets. At the same time, indexation of these bonds with nominal growth rate is not beneficial for the investors who intend to diversify their investments for risk mitigation.

The secondary objective of this study is to explore into the feasibility of launching of GDP-indexed bonds in India. The conceptual discussions conclude that these bonds have the potential to succeed in the Indian market. The designing of these bonds will be crucial in generating positive response from the investors. The indexation of coupon payment with economic growth rate calls for careful determination of baseline GDP growth rate ( $g^*$ ) and expected market rate ( $r$ ).

This study suffers from limitations of benchmarking due to novelty of the instrument. The assumption behind the hedging with GDP-indexed bonds can be subjected to counter argument of use of anti-inflationary tools to check rise in inflation with rise in the GDP growth rate. Further, this study also requires greater empirical support to establish the conceptual arguments put forward.

Future studies may concentrate on optimal pricing and indexation methods. Extension studies can be done on designing of GDP-indexed bonds for country-specific conditions. Also, a well diversified portfolio of these bonds can be prepared for emerging economies. Apart from the sovereign states, large corporations, banks and financial institutions can also consider floating such bonds with countercyclical effect to improve their balance sheets.

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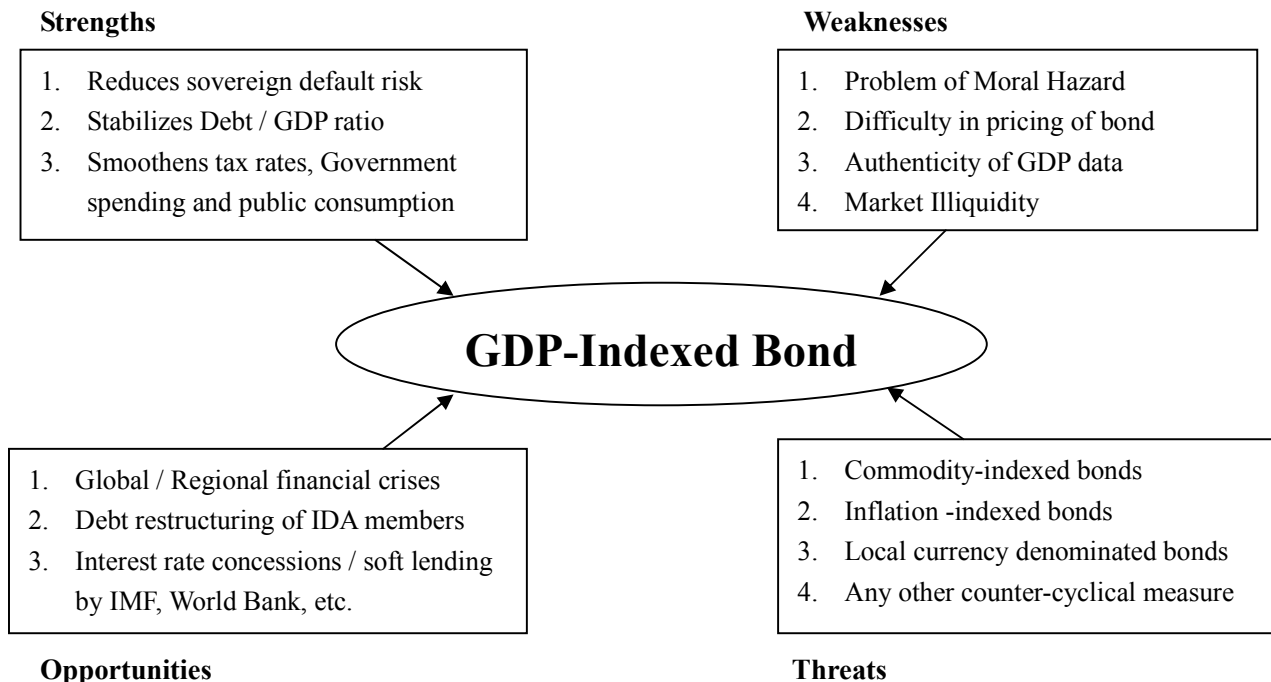


Figure 1. SWOT Analysis of GDP-Indexed Bond

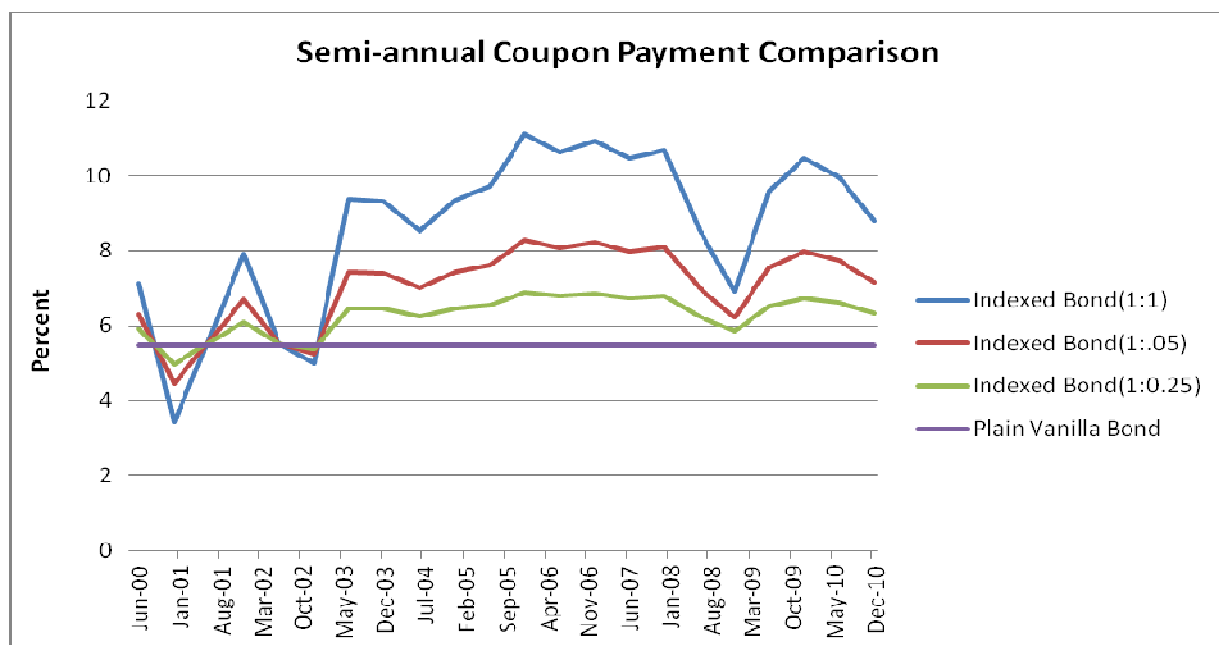
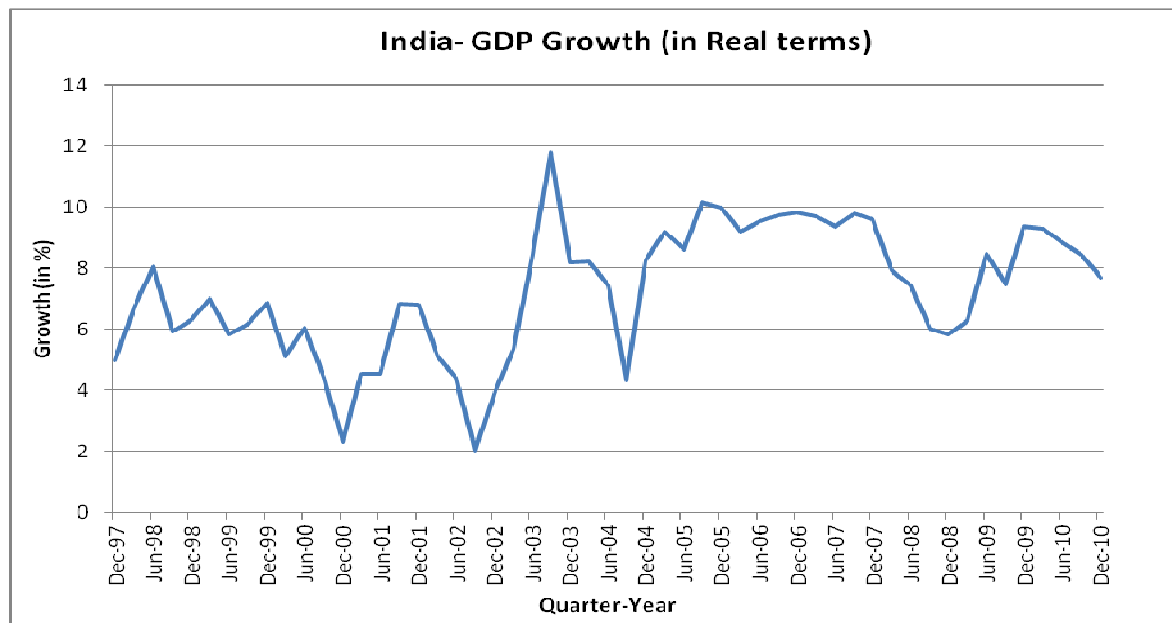
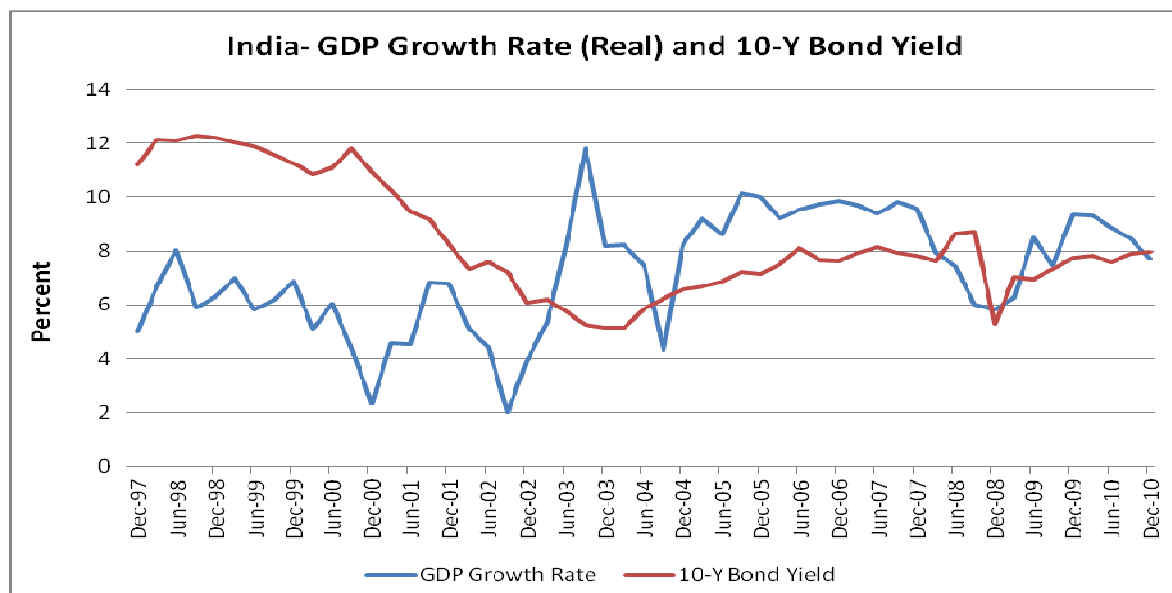


Figure 2. Comparison of Coupon payments of Plain Vanilla Bond and GDP-Indexed Bond  
(Indexation at 100%, 50% and 25%)



Source: Economic Times Intelligence Group

Figure 3. The GDP Growth Rate of India in Real terms



Source: Economic Times Intelligence Group and Gecodia.com

Figure 4. Comparative Movement of GDP Growth Rate and Return on 10-Y Bonds

Table 1. Classification of Literature on GDP-Indexed Bonds

Theme / Focus Area	Author(s)	Contribution to Research
1. Characteristics / Merits of GDP-Indexed Bonds	Borensztein & Mauro, (2002) and (2004) Borensztein et al., (2004) Griffith-Jones & Sharma, (2006) Robalino & Bodor, (2006) Griffith-Jones and Gottschalk, (2007) Ruben et al., (2008) Mendoza, (2009) Vaggi & Prizzon, (2009)	<ul style="list-style-type: none"> <li>➤ Concept of <b>GDP-Indexed Bonds (GIBs)</b>; likely benefits and obstacles; methods of indexation</li> <li>➤ Low correlation among the growth rates of emerging economies; diversified portfolio of GIB</li> <li>➤ Benefits for borrowers, investors and global economy; Case of Argentinean warrants</li> <li>➤ Invest pension funds in GIB for fiscal soundness</li> <li>➤ GIBs are useful for Islamic Financial System because they are consistent with Sharia Law</li> <li>➤ GIBs can reduce default risk; indexation should be done with nominal GDP growth rate</li> <li>➤ GIBs will ensure continued flow of international capital; mitigate effects of cyclical fluctuations</li> <li>➤ GIBs stabilize debt/ GDP ratio</li> </ul>
2. Limitations of Indexed / GDP-Indexed bonds	Peled, (1985) Gill & Pinto, (2005) Tanaka, (2005) Dardu, (2007)	<ul style="list-style-type: none"> <li>➤ Indexed bonds cause price volatility and inflation</li> <li>➤ GIBs need extended maturity period to take advantage of growth cycle fluctuations</li> <li>➤ Like other bonds, GIBs also do not motivate the borrowers for proactive restructuring of debt</li> <li>➤ Indexed bonds can lead to fluctuations in the interest rates; Concept of threshold indexation</li> </ul>
3. Pricing of GDP-Indexed bond.	Schroder et al., (2004) Kruse et al., (2005) Chamon & Mauro, (2006) D'Souza et al., (2010)	<ul style="list-style-type: none"> <li>➤ Simulation of prices under different GDP conditions; determination of circumstances under which bonds are useful for issuers and investors</li> <li>➤ In absence of economic shocks, plain bonds and indexed bonds have same return</li> <li>➤ As the proportion of GIB increases in debt/GDP ratio, default probability decreases; Use of simulation modeling for price determination</li> <li>➤ Indexation may increase probability of default depending upon the values and joint distribution of random variables in the pricing model</li> </ul>

Table 2. Descriptive Statistics (N = 132)

Instruments	Min.	Max.	Mean	Std. Dev.	Variance
GDP-Bond Coupon (Real)	3.13	12.91	8.48	2.26	5.09
GDP-Bond Coupon (Nominal)	-1.9	27.4	8.3	5.35	28.62
10-Y Govt. Bond Yields	5.11	11.81	7.68	1.54	2.38

Table 3. Correlation Relationship between Yields

Measures	GDP-Bond Coupon (R)	GDP-Bond Coupon (N)	10-Y Govt. Bond Yields
GDP-Bond Coupon (Real)	1.000		
GDP-Bond Coupon (Nominal)	0.556**	1.000	
10-Y Govt. Bond Yields	- 0.398**	-0 .057	1.000

Note: \*\*p < 0.01 (2- tailed)